Performance of Broilers Fed Ganoderma (*Ganoderma lucidum*) Mycelia Meal Treated with Chitinase in the Diet

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ABSTRACT

This study was conducted for a feeding period of 35 days to explore the potential of ganoderma mycelia as an alternative feed source for broilers. One hundred twenty straight-run, day-old broiler chicks were randomly distributed to two treatments. The performance of broilers fed ganoderma mycelia meal with and without chitinase in the diet and its profitability was determined. Average final and gain in weights, feed conversion ratio and growth rate of broilers fed Diet 2 was statistically better than those fed Diet 1. No variations were observed in the average initial weight and feed consumption. Statistically better dressing percentage with and without giblets and weight of giblets in broilers fed Diet 1 when compared with those in Diet 2.Higher cost of feed per kg gain in weight was noted in broilers fed Diet 1 but these elicited higher returns due to higher average gain in weight and final weight. The result suggests that ganoderma mycelia can improve the performance of broilers and increase profitability.

INTRODUCTION

Searching for feed supplements and additives to enhance efficiencies in aquaculture, livestock and poultry production is one of the priorities of researches in the industry. One of these researches under investigation includes the use of ganoderma (*Ganoderma lucidum*), a popular medicinal fungus and also widely known for its high nutritive value. This fungus has high protein, carbohydrates and vitamin contents. It has low amount of fiber and trace amounts of ash. Its antimicrobial component polysaccharide G was tested to be effective against pathogenic microorganisms (Yago *et. al*, 2005). Ganoderma can be massively produced using laboratory methods and could be used as an alternative feed ingredient or supplement in the formulation of feeds for aquaculture, livestock and poultry.

As cited in studies conducted in broiler, tilapia post yolk sac fry and fingerlings (Simbol, 2008; Lengoyna, 2008; Villamor, 2008, and Pablo, 2009), ganoderma contains chitin, which is a tough molecule containing complex polymer of carbohydrates. It also contains the potent immune stimulating compounds common to all medicinal mushrooms, the polysaccharides. However, nutrients and antimicrobial contents in ganoderma are trapped within the cell that could only be made available to animals by converting these into simple saccharides. Chitin which entrapped such nutrients should be first dissolved in order that these will be released. This could be attained by either adding an enzyme chitinase or by mechanical heating.

This study determined and evaluated the performance and profitability of broilers fed with ganoderma mycelia meal treated with chitinase in the diet.

MATERIALS AND METHODS

Experimental Birds

One hundred-twenty straight-run, day-old commercial broiler chicks were used as experimental birds. These were purchased from a reliable local dealer. The chicks were confined and brooded in their respective cages following the recommended space requirements for brooding chicks. Sufficient heat and light from twelve 50-watt bulbs were provided to the experimental birds for a period of three weeks. Other brooding management practices were strictly followed. All birds were provided with uniform care and management. Protection from any kind of disturbance and stress especially during uncomfortable environmental conditions were provided to the birds.

Experimental Materials

Ingredients for formulating feeds were procured from a local feed mill. Ganoderma mycelia taken from a pure culture was ground to meal form and used as a test feed additive. Ganoderma mycelia were produced at NVSU Research Laboratory. Fungal isolates were cultured following the method used by Yago (2005). The cultured ganoderma mycelia were harvested upon full colonization in culture bottles. The harvested ganoderma mycelia were thinly sliced; thoroughly dehydrated by sun-drying until it became brittle; and ground to meal form. The resulting meal was called ganoderma mycelia meal. These were packed and sealed in clean plastic bags to prevent moisture accumulation and contamination from impurities. A composite 200-g sample of the meal was taken to BioTech, University of the Philippines at Los Baños, College, Laguna for general food analysis, inorganic matter, vitamins, and antimicrobial components using Association of Official Agricultural Chemists, (1980) procedures. The ganoderma mycelia meal was premixed with a basal diet with chitinase (Diet 1) and without chitinase (Diet 2), respectively.

Experimental Design

One week before the arrival of the day-old chicks, the experimental chicken house, rearing cages, drinking and feeding troughs were thoroughly prepared, cleaned and disinfected with a commercial disinfectant. The electric bulbs were installed, tested for defects and replaced before stocking the experimental birds. The experimental birds were assigned at random to their respective experimental cages immediately after their respective initial weights were taken. All precautionary measures to prevent the occurrence of pest and diseases, especially during extremes of environmental conditions were implemented. Locally available feed ingredients were used in basal diet formulation. Two experimental diets were formulated out of these ingredients. A basal diet with ganoderma mycelia meal (Diet 2) served as the control diet. A basal diet with ganoderma mycelia meal plus chitinase (Diet 1) served as the test diet. The inclusion dose of chitinase in the feed mixture was based on the recommendation of the manufacturer, which is 3 ml per kg of ganoderma mycelia meal. The ingredient composition and calculated analyses of the experimental and basal diets were presented in Tables 1 and 2, respectively.

The experimental birds were distributed to two dietary treatments following randomization procedures of a paired experiment. Each treatment was replicated six times with 10 birds per replicate. The dietary treatments that were used in the study are the following:

Diet 1 – Basal diet + Ganoderma mycelia meal + chitinase

Diet 2 – Basal diet with Ganoderma mycelia meal (control)

Table 1. Ingredient composition of the experimental diets

Ingredients	Experimental Diets	
	Diet I (Basal Diet + G. lucidum Mycelia Meal with Chitinase)	Diet II (Basal Diet + G. lucidum Mycelia Meal without Chitinase
Yellow corn, ground	60.00	60.00
Rice bran, first class	7.53	7.53
Fish meal	10.47	10.47
Soybean meal	20.00	20.00
Limestone	0.55	0.55
Oyster shell	0.27	0.27
Tri-calcium phosphate	0.40	0.40
Salt	0.40	0.40
Vitamin-mineral premix	0.25	0.25
L-lysine	0.06	0.06
DL-methionine	0.07	0.07
Ganodermamycelia meal	+	+
Chitinase	+	-
TOTAL	**100.00**	**100.00**

Table 2. Calculated proximate, energy, chemical and amino acid analysis of the basal diet

Components	
Crude Protein, %	21.00
Crude Fiber, %	3.59
Metabolizable Energy, kcal/kg	2995.36
Calcium, %	1.00
Total Phosphorus, %	0.73
Lysine, %	1.20
Methionine, %	0.45

Experimental Procedures

The experimental birds were fed *ad libitum* with the experimental diets immediately upon distribution into their respective dietary groups. The experimental diets were spread on the paper matting during the early part of the experiment, and self-feeders onwards to the termination of the study. Brown sugar dissolved in water was provided to the birds upon arrival that served as an anti-stress. Water was made available to the birds at all times. The feed and drinking water of the birds were totally free from antibiotic.

In getting the dressing percentage with and without giblets representative samples of four birds (two males and two females) were randomly taken from each treatment groups. These were dressed for data collection. The birds were fasted for a 12-hour period before dressing to facilitate evisceration, and ensure that no visceral contents were included during the weighing. Killing was by conventional bleeding. Feathers were plucked after a proper scalding process. The shanks and heads were cut after evisceration and thorough cleaning.

Data Collection

Data collection was done immediately

upon arrival of the experimental birds and continued up to the termination of the study.

Data gathered were: initial weight; final weight; feed consumption; feed conversion ratio; growth rate; dressed weight with giblets; dressed weight without giblets; weight of giblets; dressing percentage; cost of feed per kg gain (CFG); and return above feed cost (RAFC)

Statistical Analysis

All data were statistically analyzed using analytical procedures for paired experiments. Significant differences between treatment means were compared using the Student's t-test for paired observations.

RESULTS AND DISCUSSION

Initial Weight

It was observed that average initial weights were statistically similar indicating homogeneity of the day-old chicks in this parameter (Table 3).

Average Final Weight

Results of the study revealed broilers fed Dwith ganoderma mycelia meal with chitinase (Diet 1) elicited heavier final body weights than broilers fed with ganoderma mycelia meal without chitinase (Diet 2). The better final weight of broilers fed Diet 1 over the Diet 2 was attributed to the use of chitinase in the diet containing ganoderma mycelia meal. Previous studies on the use of ganoderma in broiler feeding (Simbol, 2008; Pablo, 2009) and tilapia (Lengoyna, 2009 and Villiamor, 2009) have not obtained better average final weights than the control diets. Pablo (2009) postulated that the presence of indigestible chitinous surface of the mycelia made it indigestible. Much of the nutrients in the mycelia were trapped and made unavailable for digestion. The chitinase used to treat ganoderma mycelia meal in this study was assumed to have dissolved the chitin in the mycelia, which released nutrients and antimicrobial components important in attaining better average final weight of broilers in this study.

Average Final Gain in Weight

Broilers given diet with ganoderma mycelia meal treated with chitinase had better average final gain in body weight than broilers given with the control diet (Table 3).

Table 3. Performance of broilers fedganoderma mycelia meal with and without chitinase in the diet

Parameters	Treatments		CV, %	Computed t Values
	1 (GMM + Chitinase	II (GMM - Chitinase		
Average initial weight, g ns	68.33	69.17	3.38	(0.62)
Average final weight, g **	1641.67	1429.17	5.91	4.06
Average gain in weight g **	1573.33	1360.00	6.19	4.07
Average feed consumption, g ns	3183.33	3166.67	3.98	(0.23)
Average feed conversion ratio **	1.89	2.35	4.09	6.99
Growth Rate, % **	37.52	32.28	6.35	4.02

ns = Not significant difference between Diets 1 and 2;
*** = Highly significant - Diets 1 and 2 are significantly different*
tc 0.05 = 2.23
tc0.01 = 3.17

Average Feed Consumption

In terms of absolute value, broilers given ganodema treated with chitinase consumed less than broilers given untreated ganoderma in the diet (Table 3). However, no significant variation was observed when this was subjected to t-Test. This implies that Diet 1 was palatable and acceptable as Diet 2. This further means that the chitinase has not affected the feed intake and palatability of the experimental diet.

Average Feed Conversion Ratio

The standard feed conversion ratio for commercial broiler production ranges from 1.90 to 1.99. Broilers fed with Diet 1 had an average feed conversion ratio which was better when compared to broilers fed Diet 2. Since no significant variations in feed consumption was observed, the significantly better average feed conversion ratio of the broilers in the treated diet as compared to the control was attributed to the significantly heavier gain in weight of the broilers.

Average Growth Rate

Birds fed with Diet 1 grew statistically better than those in Diet 2 (Table 3). Consistent with the results on average final and gain in weight, average growth rate of birds fed Diet 1 was attributed to the chitinase which was assumed to have released the nutrients in the ganoderma mycelia meal. These nutrients were utilized for growth and development of the treated birds. This assumption was based on the fact that management procedures and amount of feed ingredients were all the same except for the inclusion of chitinase in Diet 1.

Dressing Recovery

Dressing percentage. The dressing recovery of birds in the study was measured as dressing percentage with and without giblets and weight of giblets (Table 4).Apparently, broilers fed Diet 1 gave a significantly better dressing percentage with and without giblets than those fed Diet 2. This implies that the diet affected the dressing percentage of the experimental birds. Birds given Diet 1 proves effective in converting this to better dressing percentage when compared to birds fed Diet 2. This finding conformed to the study of Ogbe *et al.*, (2008), which observed that aqueous extract of the wild mushroom (*Ganoderma lucidum*) improved the carcass yield of broilers.

Weight of giblets. Weight of giblets of broilers is shown in Table 4. Consistent with the dressing percentage with and without giblets of the experimental birds, weight of giblets also differed significantly. Birds fed Diet 1 had heavier weight of giblets than birds fed with Diet 2.

Table 4. Summary of results on the dressing recovery of broilers fed ganoderma mycelia meal with and without chitinase in the diet

Parameters	Treatments		CV, %	Computed t Values
	1 (GMM + Chitinase	II (GMM - Chitinase		
Dressing percentage with giblets, % **	76.23	71.71	1.33	7.94
Dressing percentage without giblets, % **	70.33	65.72	1.58	7.44
Weight of giblets, g **	97.50	85.67	4.36	5.14

*** = Highly significant Diets 1 and 2 are significantly different*
tc 0.05 = 2.23
tc 0.01 = 3.17

Table 5. Profitability of broilers fed ganoderma mycelia meal treated with and without chitinase in the diet

Parameters	Treatments	
	Diet 1 (GMM + Chitinase)	Diet 2 (GMM - Chitinase)
Cost of feed per unit gain in weight, PhP	54.61	49.89
Average sales, PhP	180.58	157.20
Return above feed cost, PhP	94.09	89.98

Economic Efficiency of the Diet

Cost of feed per kg gain in weight. As presented in Table 5 birds fed with Diet 1 incurred higher cost of feed per kg gain in weight than birds fed with Diet 2. The higher unit cost of feed in Diet 1 was attributed to the added cost of chitinase used in the feed.

Sales of broilers. It was evident that higher sales were realized from broilers fed with Diet 1 as compared with birds fed with Diet 2 (Table 5). Higher sales from said birds were realized because of their significantly better average final weight.

Cost of feed consumed. Even if the feed consumption was statistically not significant, cost of feed consumed differed between birds given the experimental diets. Birds fed with Diet 1 had higher cost of feed consumed than the birds fed Diet 2 because of the added cost of chitinase (Table 5). This was consistent with the cost of feed per kg gain in body weight.

Return above feed cost. Despite the higher cost of feed consumed of birds fed with Diet 1, it still registered a better return above feed cost (Table 5). Moreover, even if the prohibitive cost of chitinase had made cost of feed per kg gain in weight higher, it elicited better returns. It was assumed that more nutrients were available for the birds because of the action of chitinase in Diet 1 which has converted these to better weight gains. The statistically better feed conversion ratio of the birds was also a key factor in the higher return above feed costs of broilers fed with Diet 1.

CONCLUSION AND RECOMMENDATION

Conclusion

Based on the results of the study, the use of ganoderma mycelia meal treated with chitinase in broiler diet elicited statistically better growth performances (gain in weight, feed conversion ratio and growth rate), dressing recovery and monetary returns.

Recommendations

Based on the results of the study, the use of ganodermamycelia meal treated with chitinase is recommended for broiler feeding. It is also recommended that a study on the optimum level of treatment of chitinase in ganoderma meal be studied due to the prohibitive cost of chitinase. An organoleptic study is deemed necessary to evaluate the effect of chitinase in broiler meat. Moreover, a digestion trial is recommended to determine whether chitinase has really improved or enhanced digestibility of ganodermamycelia meal.The same study is also recommended to be conducted in other livestock and other poultry species to verify the consistency of results.

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